
MEASUREMENT OF THE EFFECTIVE CROSS SECTION OF THE $^{233}\text{Th}(n, \gamma)^{234}\text{Th}$ REACTION USING THE KUR

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The cross section value of the second half of the $^{232}\text{Th}(n, \gamma)^{233}\text{Th}(n, \gamma)^{234}\text{Th}$ reactions is determined. Approximately 100 mg of solid thorium (IV) nitrate tetra-hydrate ($\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$) was irradiated together with 0.1143% Au-Al and 0.483% Co-Al alloy foils, in order to monitor the Westcott thermal neutron flux and epithermal index, viz the strength of the epithermal dE/E component relative to the density of neutrons including both thermal and epithermal neutrons, by the multiple-foil activation method using the $\text{Au}(n, \gamma)$ and $\text{Co}(n, \gamma)$ reactions. The irradiation was performed at 5000 kW for 5 h in the Kyoto University Reactor (KUR). More than 13 days after the irradiation, thorium was chemically purified. The gamma-ray spectra of the purified thorium were obtained using high-purity Ge detectors (HPGe) to determine the activity of ^{234}Th . The amount of ^{232}Th recovered after the chemical purification was determined by the activation method. Effective cross section of the $^{232}\text{Th}(n, \gamma)^{233}\text{Th}$ reaction, which is necessary in the process of the determination of the $^{233}\text{Th}(n, \gamma)^{234}\text{Th}$ cross section, was calculated using the evaluated cross section and resonance integral in Japanese evaluated nuclear data library (JENDL)-3.2. The effective cross section varies mainly according to the epithermal index and the effective cross section of the $^{232}\text{Th}(n, \gamma)^{233}\text{Th}$ reaction. Therefore, although, the comparison of the effective cross sections cannot be made unconditionally, our results are slightly smaller than the widely used value.